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ably well in their endeavor, to enlist an ever increasing number of members in active service, in the conviction that there are many others well qualified to assume some of the responsibilities of the organization besides those who have as yet been chosen. Just how to accomplish this in the preliminary ballot without causing too great a scattering of votes and on the other hand without interfering with the members' free choice, is a puzzling question. A suggestion has been made that a list of names might be proposed for the various offices when the blanks for the preliminary ballot are sent to the members, this list to be large enough and representative enough so that the members would still have a real choice, yet might avoid the disadvantage mentioned under the next head, while there would also be the possibility of proposing other names than those on the suggested list. (3) The same names are often proposed for different offices, and the popular vote for a certain person is thus weaker than if concentrated upon one office. The Council has directed its nominating committees, in choosing the second candidate for each office, to take into account the total vote which each person has received for all the offices. This will materially aid in interpreting the wishes of the members; yet it would be a further improvement if this duplication of voting could be avoided.

It is to be understood that full secrecy is observed in all matters connected with the balloting. To make sure that the necessity of signing the ballots will not act as a deterrent in voting, the secretary will hereafter ask each member to return the *unsigned* ballot, putting his name on the outside of the envelope merely for the purpose of enabling the name of the member to be checked off from the membership list. Any suggestions as to improvements in the machinery of balloting will be gladly received by the secretary. The ends desired from the method adopted by the Association will be attained only if all members devote a stamp and a few moments' time, if no more, to each of the two ballots of the year.

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## THE SECOND ANNUAL MEETING OF THE MISSOURI SECTION.

The second annual meeting of the Missouri Section of the Mathematical Association of America was held in Kansas City on Saturday, November 17, 1917, in conjunction with the meeting of the Missouri State Teachers' Association. The session was held in the Public Library. The chairman of the Section, Professor L. D. Ames of the University of Missouri, presided.

Twenty-one visitors were present and the following fifteen members:

L. D. Ames, University of Missouri, Columbia.

Austin C. Andrews, Manual Training High School, Kansas City.

Otto Dunkel, Washington University, St. Louis.

Zoe Ferguson, Central High School and Junior College, St. Joseph.

R. R. Fleet, William Jewell College, Liberty.

B. F. Finkel, Drury College, Springfield.

Mary E. Helwig, High School, Kansas City, Kansas.

C. E. Horne, Park College, Parkville.

Thomas W. Jackson, High School, Fulton.

William A. Luby, Polytechnic Institute, Kansas City.

Paul R. Rider, Washington University, St. Louis.

William H. Roever, Washington University, St. Louis.

R. A. Wells, Park College, Parkville.

Ella Woodyard, High School, Kansas City, Kansas.

William H. Zeigel, Missouri State Normal School, Kirksville.

The officers elected for the ensuing year are Professor William H. Roever, Washington University, St. Louis, Chairman; Professor O. D. Kellogg, University of Missouri, Columbia, Vice-Chairman; Dr. Paul R. Rider, Washington University, St. Louis, Secretary-Treasurer.

The program of the meeting, with abstracts of papers, follows below. In the absence of Professors Dean and Scarborough their papers were read by title.

#### ABSTRACTS OF PAPERS.

##### 1. *Some Properties of Plane and Spherical Triangles and their Frequent Analogies.*

By Professor WILLIAM H. ZEIGEL, Missouri State Normal School, Kirksville.

Professor Zeigel called attention to the fact that trigonometric functions and hyperbolic functions are special cases of elliptic functions, also that plane trigonometry is a special case of spherical trigonometry where the radius of the sphere becomes infinite. Formulæ of spherical trigonometry go over into corresponding formulæ of plane trigonometry. It is an interesting exercise to obtain these analogous forms by a direct method.

If  $T$  denotes the area of a plane triangle,  $r_1$  the radius of a sphere, and  $\sigma = \sqrt{\sin s \sin (s - a) \sin (s - b) \sin (s - c)}$ , it follows that

$$\lim_{r_1 \rightarrow \infty} (\sigma r_1^2) = \sqrt{s_1(s_1 - a)(s_1 - b)(s_1 - c)} = T,$$

where the sides are expressed in circular measure. But  $r_1$  usually equals unity, hence it appears that  $\sigma$  is a form analogous to that expressing the area of a plane triangle.

For relations involving the area, sides, angles, altitudes, radii of inscribed, circumscribed, and escribed circles in the plane triangle, many analogous forms are found involving corresponding parts in the spherical triangle. Four rules pertaining to identical and co-functional relations were obtained which shorten materially the theoretical work of spherical trigonometry.

Numerous frequently analogous forms were deduced.

##### 2. *The Value of Mathematics in Secondary Education.* By Dr. JOHN W. WITHERS, Superintendent of Instruction, St. Louis.

The discussion on the foregoing paper was led by Miss ZOE FERGUSON, Central High School and Junior College, St. Joseph, and Professor B. F. FINKEL, Drury College, Springfield.

3. *Sundials and Skylights*. By Professor WILLIAM H. ROEVER, Washington University, St. Louis.

Professor Roever's paper began with a general discussion of sundial construction. He then showed how the methods of dialing could be used to determine the form of the skylight in the conical roof of a circular prison so that every cell would receive the direct rays of the sun either from exterior windows or through the skylight, for a portion of the day the year around.

4. *Pure and Applied Mathematics in the Nineteenth Century*. By Professor G. R. DEAN, Missouri School of Mines, Rolla.

5. *The Equal Parallax Curve for Frontal and Lateral Vision*. By Dr. PAUL R. RIDER, Washington University, St. Louis.

It seems evident that those creatures having side vision, such as birds, have an advantage over those having frontal vision, such as man, in their ability to gauge the relative distances of their surroundings, since the axis of their vision is perpendicular to the direction of their motion, and hence as they move forward the apparent displacement of objects is a maximum. The equal parallax curve is a curve showing the distances that a man and a bird must move forward to give the same apparent displacement of objects against the horizon. This paper derives parametric equations of the curve. It appeared in *Science*, new series, Vol. 46, No. 1183, pp. 213-214.

6. *A Simple Derivation of the Derivatives of the Trigonometric Functions*. By Professor OTTO DUNKEL, Washington University, St. Louis.

The formulæ for the derivatives of  $x$  and  $y$  with respect to the length of arc of a curve  $dx/ds = \cos \tau$ ,  $dy/ds = \sin \tau$  can easily be developed in the early part of the calculus and this is done in several texts. These formulæ depend upon the same fundamental limit that is used in the usual development of the derivatives of the trigonometric functions and yield these derivatives when applied to the circle of unit radius. For this special curve we have  $x = \cos \theta$ ,  $y = \sin \theta$ ,  $s = \theta$ , and  $\tau = \pi/2 + \theta$ , as is easily seen from a figure. On substituting these values in the formulæ above, we have at once the derivative of  $\cos \theta$ , and of  $\sin \theta$ . It is readily seen that this deduction holds for any angle  $\theta$ .

7. *The Graphical Solution of a Cubic Equation having Complex Roots*. By Mr. WILLIAM A. LUBY, Polytechnic Institute, Kansas City.

Mr. Luby's paper assumed the cubic in the form  $y \equiv x^3 + px + q = 0$ . The three values of  $x$  which make  $y$  zero are of the form  $a \pm ib$  and  $c$ . Then it follows that

$$(1) \quad a + ib + a - ib - c = 0,$$

$$(2) \quad (a + ib)(a - ib) + (a + ib)c + (a - ib)c = p,$$

$$(3) \quad (a + ib)(a - ib)c = q - y.$$

From (1), (2), and (3), we have

$$(4) \quad y = -8a^3 - 2ap + q,$$

$$(5) \quad y = q \pm \frac{2}{3} \sqrt{\frac{b^2 - p}{3}} (4b^2 - p).$$

In (4)  $a$  and  $y$  are variables, in (5)  $b$  and  $y$ . Constructing the graphs of (4) and (5) we obtain readily the complex roots of  $x^3 + px + q = 0$ .

8. *Applied Mathematics for the Average Student*. By Professor J. H. SCARBOROUGH, Missouri State Normal School, Warrensburg.

9. *The Solution of Linear Differential Equations with Periodic Coefficients*. By Dr. JAMES E. McATEE, William Jewell College, Liberty.

Dr. McAtee made a report on a paper by Professors F. R. Moulton and W. D. MacMillan of the University of Chicago on "The Solution of Certain Types of Differential Equations with Periodic Coefficients." This paper is to be found in Vol. 33 of the *American Journal of Mathematics*. PAUL R. RIDER,

Secretary.

## REPORT OF ORGANIZATION OF THE ILLINOIS SECTION.

At the call of Professor H. E. Slaught the following persons met in Room 38 of Ryerson Physical Laboratory, University of Chicago, at 4:30 P.M., on December 27, 1917, to discuss a plan for organizing an Illinois Section of the Mathematical Association of America: I. A. Barnett, G. A. Bliss, H. E. Cobb, C. E. Comstock, M. W. Coultrap, A. R. Crathorne, D. R. Curtiss, A. Emch, J. A. Foberg, J. O. Hassler, Miss Nelle Ingels, E. B. Lytle, M. McNeill, H. L. Olson, H. L. Rietz, Mr. Scheibler, J. B. Shaw, C. H. Sisam, E. J. Townsend, and E. J. Wilczynski.

Mr. J. A. Foberg, of Crane Junior College, Chicago, was unanimously elected chairman of the meeting; he appointed Mr. E. B. Lytle secretary.<sup>1</sup> A motion of Professor Townsend that an Illinois Section be organized was unanimously adopted. Among other plans it was suggested but not determined that the meetings of this new Illinois Section be held at the time and place of the meetings of the Illinois Academy of Science.

On motion of Professor Wilczynski the chairman was authorized to appoint four members who with the chairman shall constitute an executive committee with full power to arrange the time, place and program for the first meeting of the Illinois Section. In addition to the chairman, the members of this committee are: Nelle L. Ingels, Greenville College; C. E. Comstock, Bradley Polytechnic Institute; G. T. Sellew, Knox College; and L. S. Shively, Mount Morris College.

<sup>1</sup> Mr. Lytle was appointed secretary at the close of this meeting, so that these minutes are written up from memory.